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| 09/701,534 | 11/30/2000 | Shunichi Seki | 107291 | 5481 |

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EXAMINER

CLEVELAND, MICHAEL B

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| ART UNIT | PAPER NUMBER |
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1762

DATE MAILED: 04/09/2003

9

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/701,534

Applicant(s)

SEKI ET AL.

Examiner

Michael Cleveland

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 January 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-23 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

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DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 5-9, 14-15, and 17-22 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for cyclic compounds with $m=n$, $2n-2$, or $2n$ does not reasonably provide enablement for $m=2n+2$ because a cyclic compound of the claimed formula can have at most $2n$ bonds to attach hydrogen or halogen atoms. The use of cyclic compounds of the claimed formula with $b=2a+c+2$ is not possible for similar reasons. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make or use the invention commensurate in scope with these claims.

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 7 and 13 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 7: Parent claim 1 states that "the silicon compound" have at least one cyclic structure. Claim 7 further refines that "the silicon compound" is a composition containing two further silicon compounds. It is unclear whether the claims state whether either of the specified compounds must be cyclic. The claim has been treated as requiring a composition that includes at least a compound of each formula listed in the claim and as requiring that the composition must contain a further silicon compound that is cyclic or else that at least one of the compounds satisfying one of the claimed formulae is cyclic.

Claim 13: "being" should apparently be "having", as in claim 22.

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Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 14 and 17 are rejected under 35 U.S.C. 102(b) as being anticipated by Hirai et al. (U.S. Patent 4,683,146, hereafter '146).

'146 teaches cyclic silanes (abstract) that are used as silicon precursors (col. 1, lines 5-11) that are used as liquids (col. 3, lines 15-18; col. 4, lines 53-56). Liquids are ink-jet printable.

7. Claims 15 and 18 are rejected under 35 U.S.C. 102(b) as being anticipated by Winkler et al. ("Through-Bond Interactions in Silicon-Phosphorus and Silicon-Arsenic Compounds..." *Chemistry—A European Journal*, **3**, 874-880.)

Winkler teaches methods of synthesizing compounds such as $\text{Si}_6\text{H}_{12}\text{P}_2$ (compound 1a, see p. 875). The compounds are synthesized in liquids (Experimental, p. 879). Liquids are ink-jet printable.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any

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evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

10. Claims 1-5, 8, 14, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yudasaka et al. (U.S. Patent 5,989,945, hereafter '945) in view of Hirai et al. (U.S. Patent 4,683,146, hereafter '146).

Claims 1 and 14: '945 teaches a method for forming a silicon film for a device such as a thin film transistor (Abstract) comprising:

applying a coating solution (i.e., an ink composition) containing a silicon compound onto a substrate (col. 14, line 60-col. 16, line 16; Abstract). The solution may be deposited by ink-jet printing (col. 20, lines 35-40).

'945 does not teach that the silicon compound is cyclic. However, '146 teaches cyclic silanes (abstract) that are used as silicon precursors (col. 1, lines 5-11) that are liquids at room temperature (col. 3, lines 15-18; col. 4, lines 53-56). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have substituted the cyclic silane precursors of '146 for the silane precursors of '945 with the expectation of similar results and with a reasonable expectation of success because '146 demonstrates that they are also useful as decomposable precursors to form silicon films.

Claim 2: The solution coating may take place under an inert atmosphere ('945, col. 16, lines 29-31).

Claim 3: The solvent is evaporated (i.e., removed) after deposition ('945, col. 14, lines 4-12) and the film is pyrolyzed (col. 15, lines 10-26).

Claim 4: The silicon film may be crystallized by laser treating to form a crystalline film ('945, col. 15, lines 6-26).

Claims 5, 8, 14, and 17: The precursor may be Si_5H_{10} . ('146, col. 3, lines 15-18).

11. Claims 7, 16, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yudasaka '945 in view of Margrave '512.

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'945 teaches the formation of semiconductor silicon thin films, but does not teach the use of a compound containing silicon and either boron or phosphorus to deposit the silicon films.

'945 teaches that the solution may contain Si_3H_8 .

'512 teaches liquid compositions containing perfluoroborosilanes, such as $\text{Si}_4\text{BF}_{11}$ and $\text{Si}_5\text{BF}_{13}$ (col. 2, lines 41-65) and teaches that the taught compounds decompose to form silicon films (col. 7, lines 6-10). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used both the silicon precursors of '945 and the precursors of '512 simultaneously to form the silicon films because both are taught as useful for that purpose. It has been held to be *prima facie* obvious to combine two compositions taught by the prior art to be useful for the same purpose, in order to form a third composition to be used for the same purpose. *In re Kerkhoven* 626 F.2d 846, 850, 205 USPQ 1069, 1072 (CCPA 1980). See MPEP 2144.06.

12. Claims 10-12 and 19-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yudasaka '945 in view of Hirai '146 as applied to claim 1, and further in view of Kotaro et al. (JP 06-191821, hereafter '821).

'945 and '146 are described above, but do not explicitly teach using a hydrocarbon solvent with a vapor pressure in the claimed range, or a silane concentration within the claimed range.

Claims 10-11 and 19-20: '945 teaches the use of an alcohol solvent (col. 14, lines 4-12), but not a hydrocarbon with a vapor pressure at room temperature of 0.001-50 mmHg. However, '821 teaches other solvents that are suitable for depositing solution of silanes to form silicon films, such as ethylbenzene [0008], a hydrocarbon with a vapor pressure of approximately 10 mmHg at room temperature (See CRC Handbook of Chemistry and Physics, 47th edn., Weast, R.C., ed., p. D-125.) It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used ethylbenzene instead of an alcohol as the solvent with a reasonable expectation of success and with the expectation of similar results because '821 teaches that ethylbenzene is a suitable solvent for depositing such silanes.

Claims 12 and 21: '945 does not teach concentrations of the silane in the solution. Therefore, one of ordinary skill in the art would have been motivated to have looked to the

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related art to have determined operative concentrations. '821 teaches that the silane concentrations may be 0.1-50 % by weight. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have chosen a weight percent, such as 0.1 weight percent from within the claimed range with a reasonable expectation of success because '821 demonstrates that such concentrations are operative for depositing such silanes.

13. Claims 13 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yudasaka '945 in view of Hirai '146 as applied to claim 1, and further in view of Taniguchi et al. (U.S. Patent 5,667,572, hereafter '572).

'945 and '146 are described above, but do not explicitly teach using inks with the claimed viscosities or surface tensions. In fact, '945 is silent as to the viscosity and surface tension of the ink. Accordingly, one of ordinary skill in the art would have been motivated to have looked to the related prior art to determine operable viscosities and surface tensions for ink jet inks.

'572 teaches that ink jet inks (col. 1, lines 7-10) may usefully have viscosities of 1-10 cP and surface tensions of 25-70 dyn/cm (col. 9, lines 11-31). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used such values as the particular values of the viscosity and surface tension for the ink of '945 with a reasonable expectation of success because '572 teaches that such viscosities and surface tensions are useful in ink jet printing.

14. Claims 1-5, 8, 14, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yudasaka et al. (WO97/43689, hereafter '689) in view of Hirai '146 for substantially the same reasons given above (WO97/43689 is the international application from which '945 matured.).

Claims 7, 16, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yudasaka '689 in view of Hirai '146 and Margrave '512 for the same reasons given above relating to Yudasaka '945 in view of '146 and '512.

Claims 10-12 and 19-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yudasaka '689 in view of Hirai '146 and Kotaro et al. (JP 06-191821, hereafter '821) for the same reasons given above relating to Yudasaka '945 in view of '146 and '821.

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Claims 13 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yudasaka '689 in view of Hirai '146 and Taniguchi et al. (U.S. Patent 5,667,572, hereafter '572) for the same reasons given above relating to Yudasaka '945 in view of '146 and '572.

Double Patenting

15. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Note: Double patenting rejections based on the same patent with different secondary references have been grouped together under a single paragraph number.

16. Claims 1-23 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-2, 4-8, and 11-13 of U.S. Patent No. 6,541,354 in view of Yudasaka '689.

Claims 1 and 11 of '354 teaches a method of applying a film by applying specific cyclic silicon compounds within the claimed genus of claims 1, 5-7, 14-16, and 23 of the present application. The claims of '354 do not explicitly require ink-jet printing. However, ink-jet printing is a known method of depositing silane precursors onto substrate to form silicon films, as discussed in relation to '689 above. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used ink-jet printing as the particular method of applying with a reasonable expectation of success because Yudasaka '689 teaches that ink-jet printing is a successful method of depositing silane precursors.

Claim 2: Yudasaka also teaches inert gas atmospheres.

Claims 3-4: See '354, claims 6 and 8.

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Claims 5-9, 14-18, and 23: See '354, claims 1-2 and 11-13.

Claims 10-13 and 19-22: See '354, claims 4-5 and 7. Because the claimed solvents are identical, and the currently claimed vapor pressure, concentrations, and viscosities are well within those of the patent, the claimed surface tensions appear to be required.

Claims 13 and 22 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-2, 4-8, and 11-13 of U.S. Patent No. 6,541,354 in view of Yudasaka '689 and Taniguchi '572 for the same reasons given immediately above, and for the teachings of '572 regarding ink-jet surface tensions already discussed.

17. Claims 14-18 and 21 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 4, 6, and 9 of U.S. Patent No. 6,527,847. Although the conflicting claims are not identical, they are not patentably distinct from each other because the claims of the patent are within the genus of the applications claims.

Claims 1-9, 12, and 23 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 4, 6, and 9 of U.S. Patent No. 6,527,847 in view of Yudasaka '689. '847 states that the composition is a coating composition, but the claims do not suggest a method of applying the composition. Yudasaka '689 teaches depositing silane coating compositions by ink-jet printing. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used ink-jet printing as the particular method of applying with a reasonable expectation of success because Yudasaka '689 teaches that ink-jet printing is a successful method of depositing silane precursors. The features of claims 2-5 have been discussed with regard to Yudasaka above.

Claims 10-12 and 19-21 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 4, 6, and 9 of U.S. Patent No. 6,527,847 in view of Yudasaka '689 as discussed in this section and in view of Kotaro et al. (JP

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06-191821, hereafter '821) for the teachings of Kotaro regarding solvent characteristics discussed above.

Claims 13 and 22 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 4, 6, and 9 of U.S. Patent No. 6,527,847 in view of Yudasaka '689 as discussed in this section and in view of Taniguchi '572 for its teachings regarding ink-jet surface tensions already discussed.

18. Claims 1, 3, 10-11, 13-20, and 22-23 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-10 and 15-16 of U.S. Patent No. 6,518,087. Although the conflicting claims are not identical, they are not patentably distinct from each other because the process of '087 encompasses the currently claimed process (and compositions). The features of the current dependent claims are permutations of the features and species of claims 1-10 and 15-16 of '087.

Claim 2 is rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-10 and 15-16 of U.S. Patent No. 6,518,087 in view of Yudasaka '689. The claims of '087 do not specify an atmosphere. Yudasaka '689 teaches forming silicon coatings by depositing silane coating compositions by ink-jet printing in an inert atmosphere. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used an inert atmosphere as the particular atmosphere of the claims of '087 with a reasonable expectation of success because Yudasaka '689 teaches that inert atmospheres are appropriate for the operation.

Claims 12 and 21 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-10 and 15-16 of U.S. Patent No. 6,518,087 in view of Kotaro '821 for its teachings regarding solvent characteristics already discussed above.

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19. Claims 1, 3, 5, 8, 12, 14, 17, and 21 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-10 and 15 of U.S. Patent No. 6,503,570. Although the conflicting claims are not identical, they are not patentably distinct from each other because the current claims encompass different combinations of the features of the claims of '570.

Claims 2 and 4 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-10 and 15 of U.S. Patent No. 6,503,570 in view of Yudasaka '689. The claims of '570 do not specify an atmosphere. Yudasaka '689 teaches forming silicon coatings by depositing silane coating compositions by ink-jet printing in an inert atmosphere. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used an inert atmosphere as the particular atmosphere of the claims of '087 with a reasonable expectation of success because Yudasaka '689 teaches that inert atmospheres are appropriate for the operation. The teachings of Yudasaka '689 regarding crystallizing silicon are relevant to claim 4 for the reasons discussed above.

Claims 10-11 and 19-20 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-10 and 15 of U.S. Patent No. 6,503,570 in view of Kotaro '821 for its teachings regarding solvent characteristics already discussed above.

Claims 13 and 22 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-10 and 15 of U.S. Patent No. 6,503,570 in view of Taniguchi '572 for its teachings regarding ink-jet surface tensions already discussed.

Response to Arguments

20. Applicant's arguments filed 1/23/2003 have been fully considered but they are not persuasive.

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The rejections of claims 4 and 22 under 35 USC 112, 2nd paragraph have been overcome by amendment. The rejection of claim 13 under 35 USC 112, 2nd paragraph has been substantially overcome by amendment, but the informality discussed above remains.

Applicant's arguments regarding cyclic structures is unconvincing in view of the newly cited art.

Applicant's arguments regarding claims 16 and 23 that neither Yudasaka nor Margrave individually teaches a composition with both claimed compounds is unconvincing because it does not address the combination of references because it has been held to be *prima facie* obvious to combine two compositions taught by the prior art to be useful for the same purpose, in order to form a third composition to be used for the same purpose. *In re Kerkhoven* 626 F.2d 846, 850, 205 USPQ 1069, 1072 (CCPA 1980). See MPEP 2144.06.

Conclusion

21. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

22. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Cleveland whose telephone number is (703) 308-2331. The examiner can normally be reached on 9-5:30 M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck can be reached on (703) 308-2333. The fax phone numbers for the

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organization where this application or proceeding is assigned are (703) 306-3186 for regular communications and (703) 306-3186 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

MA ©

MBC

April 5, 2003


SHRIVE P. BECK
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700